Female Competition and the Challenge Hypothesis: Insights from a Feisty Female Bird

The bi-directional links between hormones and behavior have been a rich area of research for decades, perhaps especially so for the vertebrate sex steroid testosterone (T). Nearly 30 years ago, theory on the evolution of T levels was advanced by the "challenge hypothesis" (Wingfield et al. 1990, American Naturalist), which presented a framework for understanding male patterns of T secretion within and among species. By and large, interspecific, seasonal, and social variation in T levels in males appears to be shaped by the competing demands of parental care vs. male-male aggression. Female competition and aggression are also widespread; however, it is unclear whether and how the challenge hypothesis applies to females. Here, I will present data from my lab, which seeks to identify mechanisms of female aggression and how they evolve. We study the tree swallow (*Tachycineta bicolor*), a cavity-nesting bird for which social challenges from prospecting rivals pose a very real threat to territorial females. Our results demonstrate that female aggression is adaptive and mediated by T. However, seasonal changes in aggression do not mirror changes in T in circulation, suggesting that additional mechanisms must exist to allow for marked aggression in the face of low T. Our data reveal how seasonal changes in ovarian gene regulation may influence sex steroid production, including high levels of androgen synthesis during the time when females are establishing territories. We also show how seasonal variation in tissue level processing of T (i.e. local steroidogenesis and receptor expression) may support aggression in the absence of elevated T in circulation. Ongoing work investigates the degree to which these seasonal changes in hormones, genes, and behavior also respond to direct social challenges, with the ultimate goal of developing a framework for understanding mechanisms of social competition in females and how they are shaped by natural selection.